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**LIQUID DETERGENT COMPOSITION**

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6

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LIQUID DETERGENT COMPOSITION

[Ekitai senjyouzai soseimono]

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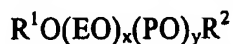
[There are no amendments to this patent.]

Claim

/1\*

A liquid detergent composition, characterized by comprising (A) 0.1-10 wt% of a swellable clay mineral;

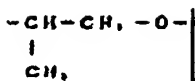
(B) 0.1-30 wt% of a solvent represented by general formula (1):



(in the formula, R<sup>1</sup> denotes a carbon number [sic] or an alkyl group with a carbon number of 1-4, R<sup>2</sup> denotes hydrogen or an alkyl group with a carbon number of 1-4, EO denotes -CH<sub>2</sub>-CH<sub>2</sub>-O-, PO denotes

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\* [The numbers in the right margin indicate pagination of the original foreign text.]



x denotes 0-8, y denotes 0-3, and  $x + y \geq 2$ ;

(C) 1-20 wt% of a surfactant; and

(D) 0.5-30 wt% of an alkali agent.

#### Detailed description of the invention

The present invention relates to a liquid detergent composition that is appropriate for organic materials adhered to household stoves, ovens used in cooking, vents, plywood, glass, refrigerators and other kitchen items, and in particular, for tough stains resulting from thermal and oxidative modification of oils.

Stains present on fans, walls, plywood, glass, refrigerators and other kitchen items are often produced by the adhesion of oil used in cooking or oil contained in foods when the oil is discharged as microparticles during heating. When these oils are left for long periods of time, they are converted into a brown sticky resinous material under the action of oxidation by atmospheric oxygen and heat.

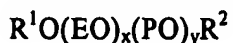
Modified oil produced in this manner is a tough stain, and cannot be removed with common detergents, and so various means have been used heretofore. In the past, liquid detergents have been known that are produced by combining monoalkyl ethers such as diethylene glycol or ethylene glycol as solvents with surfactants and alkali agents such as sodium hydroxide, potassium hydroxide, and sodium silicate. Although the capacity for removing modified oils is superior in cases where cleaning is carried out by immersion, the viscosity of the detergent has been low, and so dripping occurs with ordinary methods of use. There is thus the disadvantage that sufficient cleaning power cannot [always] be manifested. /2

The inventors of the present invention, as a result of repeated and painstaking investigations towards a solution to the above problems, arrived at the present invention upon discovering that blending an alkali agent and surfactant along with a specific solvent and swellable clay mineral not only provides good cleaning power with respect to modified oils, but also leaves no tack after wiping, and has superior use characteristics due to its appropriate viscosity.

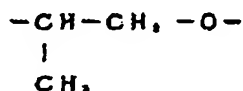
Specifically, the present invention is characterized by comprising components (A)-(D) below:

(A) 0.1-10 wt% of a swellable clay mineral;

(B) 0.1-30 wt% of a solvent represented by general formula (1):



(in the formula,  $R^1$  denotes an alkyl group with a carbon number of 1-4,  $R^2$  denotes hydrogen or an alkyl group with a carbon number of 1-4, EO denotes  $-\text{CH}_2-\text{CH}_2-\text{O}-$ , PO denotes



x denotes 0-8, y denotes 0-3, and  $x + y \geq 2$ );

(C) 1-20 wt% of a surfactant; and

(D) 0.5-30 wt% of an alkali agent.

In the present invention, examples of swellable clay minerals used as the (A) component are smectite-type clay minerals and double-chain structure clay minerals. Preferred examples include clays having, as primary components, montmorillonite, nontronite, hectorite, vermiculite, attapulgite, sepiolite, saponite and mixtures thereof. These swellable clay minerals may be used individually, or may be used in mixtures of two or more, where the blend amount is 0.1-10 wt% with respect to the entire composition, with a range of 0.5-8 wt% being preferred. If the amount is less than 0.1 wt%, the viscosity desired for stabilization will not be obtained, whereas if the amount exceeds 10 wt%, then the viscosity will be too high, which is undesirable from the standpoint of practical use.

The solvent used as the (B) component in the composition of the present invention is a polyoxyalkylene mono- (or di-) lower alkyl ether having the structure of general formula (I), and the oxyethylene and oxypropylene units of the polyoxyalkylene chain  $(\text{EO})_x(\text{PO})_y$  may have any bonding order. The solvent has a swelling action and solvation action with respect to oil and dirt, and, in contrast to other solvents that can dissolve oils, it has a favorable odor, and exhibits sufficient effects even when diluted with water. Moreover, it can be present in stable form together with the swellable clay mineral of the (A) component. Preferred solvents for use in the present invention that may be cited are triethylene glycol monopropylene glycol monomethyl ether, diethylene glycol monopropylene glycol monomethyl ether, tripropylene glycol monomethyl ether, diethylene glycol monoethyl ether, hexamethylene glycol monoethyl ether, triethylene glycol monopropyl ether, diethylene glycol monobutyl ether, triethylene glycol monobutyl ether, diethylene glycol isobutyl ether, diethylene glycol dimethyl ether, hexamethylene glycol dimethyl ether and triethylene glycol methylbutyl ether. These solvents may be used individually, or two or more may be used in mixtures. The blend amount thereof is 0.1-30 wt% with respect to the entire composition, with a range of 0.5-15 wt% being preferred. If the amount is less than 0.1 wt%, sufficient cleaning power will not be obtained, whereas dramatic improvement in cleaning power will not be seen if blended above 30 wt%.

There are no particular restrictions on the surfactant used as the (C) component, and the surfactant may be a cleaning activating component used in common household cleaning agents. Among these surfactants, examples of anionic surfactants that may be used are common sulfonate-based, sulfate-based and phosphate-based anionic surfactants. Among these anionic surfactants, examples of sulfonate-based anionic surfactants include linear or branched alkyl ( $C_{8-22}$ ) benzenesulfonates, long-chain alkyl ( $C_{8-22}$ ) sulfonates, long-chain olefin ( $C_{8-22}$ ) sulfonates, and the like. In addition, examples of sulfate-based anionic surfactants include long-chain alkyl ( $C_{8-22}$ ) sulfate esters, polyoxyethylene (1-6 mol) long-chain alkyl ( $C_{8-22}$ ) ether sulfate esters, polyoxyethylene (1-6 mol) alkyl ( $C_{8-22}$ ) phenyl ether sulfate esters, and the like. In addition, examples of phosphate-based anionic surfactants include long-chain monoalkyl, dialkyl or sesquialkyl phosphates (where the carbon number of the alkyl group is 8-22), polyoxyethylene (1-6 mol) monoalkyl, dialkyl or sesquialkyl phosphates (where the carbon number of the alkyl group is 8-22), and the like. Examples of counter ions for these anionic surfactants include cations such as sodium, potassium, magnesium and other alkali metal or alkaline earth metal ions, and monoethanolamine, diethanolamine, triethanolamine and other alkanolamine ions. Examples of nonionic surfactants include polyoxyethylene (1-20 mol) long-chain alkyl (primary or secondary  $C_{8-22}$ ) ethers, polyoxyethylene (1-20 mol) alkyl ( $C_{8-22}$ ) phenyl ethers, polyoxyethylene-polyoxypropylene block polymers and other oxyalkylene addition products, higher aliphatic alkanolamides and alkylene oxide addition products thereof, and long-chain tertiary amine oxides ( $C_{12-14}$ ) and the like.

These surfactants may be used individually, or may be used in combinations of two or more. The blend amount thereof is 1-20 wt% with respect to the total amount of the composition, and preferably in the range of 3-15 wt%. If the amount is less than 1 wt%, then the cleaning power will be inferior, whereas if the amount exceeds 20 wt%, dramatic improvement in cleaning power will not be seen.

Any inorganic alkali agent or organic alkali agent may be used as the alkali agent used for the (D) component in the present invention. Among these agents, preferred alkali agents are sodium hydroxide, potassium hydroxide, sodium carbonate, sodium bicarbonate, sodium silicate, ammonia and alkanolamine. These alkali agents are compounds that facilitate removal of modified oils by saponifying or hydrolyzing modified oils with large numbers of carboxyl groups generated through oxidative decomposition under the influence of strong thermal modification. The alkali agents may be used individually, or may be used in combinations of two or more. The blend amount is 0.5-20 wt% with respect to the total amount of composition, with 1-10 wt% being preferred. If the amount is less than 0.5%, then the capacity for removing modified oils by saponification or hydrolysis will be weak, whereas no improvement in effects will occur if the amount is in excess of 20 wt%.

In order to preserve liquid properties at low temperatures or high temperatures, the composition of the present invention may contain lower alcohols, lower alkylbenzenesulfonic acids and other hydrotropic agents; inorganic salts such as sulfates and hydrochlorides and other such viscosity conditioners; silicate sand, diatomaceous earth, calcium carbonate and other polishing agents; fragrance; dyes; and the like.

The liquid detergent composition of the present invention can readily remove modified oil stains and the like around the kitchen, and, moreover, provides excellent cleaning power and favorable safety due to its appropriate viscosity.

The product of the present invention may be used as-is, and an aerosol or spray-type product is also appropriate from the standpoint of ease of use.

Application examples are presented below in order to describe the present invention in additional detail, and the evaluation methods for the cleaning agents used in the working examples will first be discussed.

#### Cleaning power

Salad oil and carbon black were mixed at a weight ratio of 100:2, and this substance was applied uniformly onto steel plates, before baking for 40-60 min at a temperature of 170-200°C to produce stained plates. After applying liquid detergent onto the plates and leaving for a period of 5 min, a 500 g weight was placed on a cotton stocking which was wiped back and forth 10 times. The condition of the stain was then visually evaluated according to the following standards.

O: Good stain removal

Δ: Variable stain removal

X: Almost no stain removal

#### Viscosity

Measured at 25°C using a B8H viscometer.

#### Foaming

The amount of foam was visually determined after producing foam three times by application using a trigger sprayer.

O: Good foaming

Δ: Fair foaming

X: Almost no foaming

### Foam creaminess

The creaminess of the foam was observed visually after producing foam three times by application using a trigger sprayer.

O: Thick and creamy foam with fine bubbles

Δ: Somewhat fine but not thick

X: Runny, large bubbles

### Foam adhesion

A trigger sprayer was used, and a composition was foamed by application onto a vertical tile surface. The state 5 min after 3 rounds of foam coating was observed.

O: Almost no dripping

Δ: Some dripping

X: Excessive dripping

### Mist condition

The condition of mist spraying was evaluated after foaming three times by application using a trigger sprayer.

O: Almost no mist produced

D: Some mist produced

X: Fair amount of mist produced

### Application Example 1

The solvents presented in Table 1 were each used in the preparation of liquid detergents having the compositions indicated below, and the compositions were foamed by applying them using a trigger sprayer. The cleaning power and foaming were evaluated by the above methods, and the results are presented in Table 1.

Metalloid	2 wt%
(Hydrated magnesium silicate (hectorite); manufactured by Saiden Chemical)	
Solvent (refer to Table 1)	10 wt%
C <sub>12</sub> linear sodium alkylbenzenesulfonate	3 wt%
Sodium hydroxide	2 wt%
Water	Remainder

Table 1

/5

	① 本 発 明 品			比 較 例			
	1	2	3	4	5	6	7
③ 溶 剤	ジエチレングリコールモノブチルエーテル ⑪	ジエチレングリコールジメチルエーテル ⑫	トリエチレングリコールモノプロピレングリコールモノメチルエーテル ⑬	イソプロピルアルコール ⑭	酢酸エチル ⑮	3-メチル-3-メトキシブタノール ⑯	な ⑰
④ 洗 浄 力	○	○	○	△	○	○	×
⑤ 粘度 (cp)	250	300	330	280	200	320	400
⑥ 泡 発 生 性	○	○	○	△~×	△~×	△~×	×
⑧ 泡 の クリーミー感	○	○	○	×	×	×	×
⑨ 泡 の 付着性	○	○	○	×	×	×	×
⑩ ミストの状況	○	○	○	×	×	×	×

- Key:
- 1 Product of the present invention
  - 2 Comparative example
  - 3 Solvent
  - 4 Cleaning power
  - 5 Viscosity (cp)
  - 6 Foaming
  - 7 Foam amount
  - 8 Foam creaminess
  - 9 Foam adhesion
  - 10 Mist condition
  - 11 Diethylene glycol monobutyl ether
  - 12 Diethylene glycol dimethyl ether
  - 13 Triethylene glycol monopropylene glycol monomethyl ether
  - 14 Isopropyl alcohol
  - 15 Ethyl acetate
  - 16 3-Methyl-3-methoxybutanol
  - 17 None

### Application Example 2

/6

Various detergents having the compositions presented in Table 2 were prepared and the properties were evaluated in the same manner as in Application Example 1.

Table 2

		1 試 験 材								2 性 質 値			12
		3	4	5	6	7	8	9	10	11	12	13	
3	ガスモスN <sup>5</sup>	5		3	3	3							
	ビーガム <sup>6</sup>		3				3	3					
	シリカゲル <sup>7</sup>										3		
8	ポリビニルアルコール <sup>8</sup>												3
	ポリアクリル酸 <sup>9</sup>										3		
	トリエチレングリコールモノプロピルエーテル <sup>10</sup>	5	5	5	5	5	5	5	5	5	5	5	
11	C <sub>14</sub> 直鎖アルキルベンゼンスルホン酸ソーダ <sup>11</sup>	3	3			2		3	3	3	3	2	
	ラウリルアルコールEO添加物(p=8) <sup>12</sup>			3		1	3	1					
	C <sub>12</sub> アミンオキシド <sup>13</sup>				3		1						
14	苛性ソーダ <sup>14</sup>	1	1	1	1	1					1	1	
	モノエタノールアミン <sup>15</sup>						2	3	2				
	水 <sup>16</sup>	バランス											24
17	洗浄力 <sup>17</sup>	0	0	0	0	0	0	0	0	0	0	0	
	粘度(CP) <sup>18</sup>	310	320	330	240	250	250	300	15	4	10		
	泡 量 <sup>19</sup>	0	0	0	0	0	0	0	0	0	0	0	
20	泡 性 <sup>20</sup>	0	0	0	0	0	0	0	0	0	0	0	
	泡 性 <sup>20</sup>	0	0	0	0	0	0	0	0	0	0	0	
	泡 性 <sup>20</sup>	0	0	0	0	0	0	0	0	0	0	0	
21	泡 性 <sup>20</sup>	0	0	0	0	0	0	0	0	0	0	0	
	泡 性 <sup>20</sup>	0	0	0	0	0	0	0	0	0	0	0	
	泡 性 <sup>20</sup>	0	0	0	0	0	0	0	0	0	0	0	
22	泡 性 <sup>20</sup>	0	0	0	0	0	0	0	0	0	0	0	
	泡 性 <sup>20</sup>	0	0	0	0	0	0	0	0	0	0	0	
	泡 性 <sup>20</sup>	0	0	0	0	0	0	0	0	0	0	0	
23	泡 性 <sup>20</sup>	0	0	0	0	0	0	0	0	0	0	0	
	泡 性 <sup>20</sup>	0	0	0	0	0	0	0	0	0	0	0	
	泡 性 <sup>20</sup>	0	0	0	0	0	0	0	0	0	0	0	

\*1) Hydrated aluminosilicate (montmorillonite); Shiroishi Kogyo

\*2) Hydrated magnesium aluminosilicate (saponite); Vanderbilt Co.

\*3) PVA-224H; Kuraray

\*4) Reojikku [transliteration] 250H; Japan Pure Chemical

\*5) EO denotes "ethylene oxide," and p denotes the average mole number.

- Key:
- 1 Application example
  - 2 Comparative example
  - 3 Composition (wt%)
  - 4 Properties
  - 5 Oak moss N<sup>\*1</sup>
  - 6 Veegum<sup>\*2</sup>
  - 7 Silica gel
  - 8 Polyvinyl alcohol<sup>\*3</sup>
  - 9 Polyacrylic acid<sup>\*4</sup>
  - 10 Triethylene glycol monopropyl ether
  - 11 C<sub>14</sub> linear alkylbenzenesulfonate sodium salt
  - 12 Lauryl alcohol EO addition product (p = 8)<sup>\*5</sup>
  - 13 C<sub>12</sub> amine oxide
  - 14 Sodium hydroxide
  - 15 Monoethanolamine
  - 16 Water
  - 17 Cleaning power
  - 18 Viscosity (CP)
  - 19 Foaming
  - 20 Foam amount

- 21    **Foam creaminess**
- 22    **Foam adhesion**
- 23    **Mist condition**
- 24    **Balance**